

Draft Concepts for Revisions to Rule Language

30 TAC Chapter 331 (Underground Injection Control)

Background

- Scope. This rulemaking is limited to disposal of nonhazardous drinking water treatment residuals (DWTR), including DWTR containing naturally occurring radioactive materials (NORM), in Class I bedded salt cavern injection wells.
- Purpose.
 - The objective of this rulemaking is to amend existing rules, add new rules, and develop guidance pertaining to disposal of nonhazardous DWTR, including DWTR containing NORM, in Class I bedded salt cavern injection wells.
 - All other requirements for Class I nonhazardous waste disposal wells will apply.
- Minimum Standards. At a minimum, Class I wells must comply with federal standards for Class I nonhazardous waste wells (40 CFR Parts 144 and 146). TCEQ rules for Class I wells authorized to dispose of nonhazardous desalination concentrate or nonhazardous DWTR are consistent with these federal requirements, and therefore TCEQ rules are and will continue to be used in lieu of federal rules. The TCEQ rules for these wells are found in 30 TAC Chapter 331 (relating to Underground Injection Control).
- Financial assurance.
 - TCEQ requires financial assurance for plugging and abandonment and post-closure care of Class I wells that meets the requirements in 30 TAC Chapter 37 Subchapter Q (relating to Financial Assurance for Underground Injection Control (UIC) Wells).
 - The permittee must provide financial assurance in the amount of the cost estimates for plugging and abandonment and post-closure care.
- Commercial wells.
 - The commercial receipt, storage, processing or disposal of nonhazardous industrial solid waste requires a TCEQ permit in accordance with the requirements of Texas Health and Safety Code Chapter 361 and 30 TAC Chapter 335. This rulemaking project is not intending to revise any of the existing requirements for a commercial industrial waste facility.
 - For commercial NORM waste disposal, Class I injection well permitting must be accompanied by an application for a radioactive materials license.

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- General Permit (GP). Proposed rules should enable authorizing disposal of nonhazardous DWTR, including DWTR containing NORM, into Class I bedded salt cavern injection wells under the UIC GP (WDWGo10000).
- Amended subchapters. In Chapter 331, Subchapters A, C, D, G and J will be amended to specify the applicability of rules to wells in domal salt versus bedded salt.
- New Subchapter N. Analogous to Subchapter J for salt dome cavern waste disposal wells, new Subchapter N will be added to specify standards for disposal of DWTR, including DWTR containing NORM, in bedded salt waste disposal wells.
- References for Rule Concepts. In developing these rule concepts, the rulemaking team consulted testimony by Joe L. Ratigan, Ph.D., before the Kansas Senate Utilities Committee relating to Kansas' rules for underground storage of hydrocarbons in solution-mined salt caverns. The team also consulted the rules of the Railroad Commission of Texas and the states of Kansas (KAR 28-45, Underground Hydrocarbon Storage Wells) and Louisiana (LAC 43:XVII.Chapter 31, Disposal of Exploration and Production Waste in Solution-Mined Caverns).

Draft Rule Concepts (subject to change, deletion and addition)

- Definitions. The following definitions may be modified or added: bedded salt cavern, bedded salt cavern waste disposal well, and blanket material.
- Prohibition on bedded salt waste disposal. The prohibition in §331.14(a) on bedded salt waste disposal wells (i.e., Class I salt cavern solid waste disposal wells and associated caverns in geologic structures or formations other than salt stocks of salt domes) will be removed.
- Standards for bedded salt. New subchapter N, pertaining to standards for Class I bedded salt waste disposal wells and associated caverns, will be added to specify standards and requirements for such wells to dispose of DWTR, including DWTR containing NORM. New Subchapter N will be structured similarly to Subchapter J (standards for Class I salt dome waste disposal wells).
- Radioactive materials license. The use or disposal of radioactive material is subject to the applicable requirements of 30 TAC Chapter 336 (relating to Radioactive Substance Rules).
- Performance standard. The performance standard for bedded salt waste disposal wells will be the same as for other nonhazardous waste Class I wells, that is, the continuous attainment of a performance standard to prevent the movement of fluids that could result in the pollution of an underground source of drinking water (USDW).
- Siting Criteria. Requirements for siting bedded salt waste disposal wells will include existing siting requirements for Class I nonhazardous waste disposal wells as specified in 30 TAC 331.121(c). In addition, these wells must not be located less than

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100 feet from surface structures not owned by the applicant, including any transportation artery.

- Regional geology. An evaluation of the regional geology will have to be provided by the applicant to determine whether the integrity of the proposed bedded salt waste disposal cavern will be adversely affected by salt thinning due to any stratigraphic change or a dissolution zone in the bedded salt.
- Construction standards for the well. Potential construction standards for bedded salt waste disposal wells include the following:
 - Casings will be required for all Class I bedded salt cavern disposal wells, and all casings which extend to the surface will need to be cemented to prevent the movement of fluids into or between USDWs or freshwater aquifers.
 - Casing and cement used in the construction of each well will have to be designed for the life expectancy of the well.
 - Surface casing will be required to a minimum subsurface depth which extends into a confining bed below the lowest formation containing a USDW or freshwater aquifer.
 - Long string casing, using a sufficient number of centralizers, will have to be set into the salt formation.
 - Salt-saturated cementing material will be required for cementing that part of the casing opposite a salt formation.
 - Removable injection tubing(s) suspended from the wellhead will be used for injection activities for bedded salt cavern construction and waste disposal.
 - During bedded salt cavern construction the annulus between the tubing and long string casing must be filled with a noncorrosive fluid to protect the bond between the borehole, cement and long string casing seat.
 - Tubing with a packer or a fluid seal to seal the annulus between the tubing and casing must be used for injection of waste into a bedded salt cavern.
 - Appropriate logs and tests must be conducted during the drilling and construction of the well.
 - All logs and tests must be interpreted by the service company which conducted the tests or processed the logs, or by other qualified persons.
 - At a minimum, the following logs and tests will be required: deviation checks, a spontaneous potential and resistivity log, natural gamma ray log, compensated density and neutron porosity logs, acoustic or sonic log, inclination (directional) survey, caliper log (open hole), fracture detector log, and vertical seismic profile. Required cased hole logs will

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include cement bond with variable density, temperature, and casing inspection.

- Pressure tests
 - Surface casing must be pressure tested at mill test pressure or 80% of the calculated internal pressure at minimum yield strength.
 - Intermediate and long string casing must be tested to 1,500 psi for 30 minutes.
 - The bond between the salt, cement and casing must be pressure tested at 0.8 psi per foot after drilling out the cemented long string casing shoe and prior to drilling more than 100 feet of core hole or pilot hole below the long string casing shoe.
- Conventional cores will be required through the permitted injection interval and from selected intervals of the lowermost overlying confining zone. (Sidewall cores will be acceptable if full-hole coring is not feasible.) Permeability, porosity, bulk density and other necessary tests must be performed on the cores.
- Before cavern solutioning begins, any portion of the pilot hole or core hole that extends beyond the intended wall of the cavern will have to be filled with cement from total depth back to the designed boundary of the cavern.
- The mechanical integrity of the well will have to be demonstrated before the start of injection operations. Required logs and tests will include a pressure test with liquid or gas; a temperature log, noise log, or oxygen activation log; and possibly a casing inspection log.
- All materials used to construct the well must be compatible with formations and fluids which may come into contact with the well.
- A diked, impermeable pad or sump will be required at the wellhead for secondary containment.
- A professional engineer (P.E.) or professional geoscientist (P.G.), as appropriate, licensed in Texas, must supervise all phases of well construction and workovers.
- Within 90 days after well construction is completed, the permittee must submit to the executive director a completion report sealed by a P.E. or P.G., as appropriate. The report must include the information listed in 30 TAC §331.45(2).
- In connection with the completion report mentioned above, a P.E. or P.G. will have to certify that the well has been constructed according to the permit and the design and construction specifications in the application, and that the reservoir data obtained by logs and tests will not necessitate a change in the operating parameters specified in the permit.

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- Construction standards for the cavern. Potential construction standards for bedded salt waste disposal caverns include the following:
 - The waste disposal cavern will be created within bedded salt by the controlled dissolution of the sidewalls of the wellbore to a specified maximum diameter between specified depths that will determine the injection interval.
 - The applicant will be required to submit cavern construction plans which will demonstrate the following:
 - separation between adjacent caverns of a minimum pillar to cavern diameter (P/D) ratio of 2.0;
 - design of the cavern dimensions by a P.E. and/or P.G., as appropriate, to ensure the cavern's structural integrity;
 - plans for supervision of cavern construction by a P.E.;
 - use of removable injection tubing(s) that extend from the wellhead into the cavern below the long string casing seat for injection activities for cavern construction and waste disposal;
 - plans to continually monitor the volumes of materials injected and produced during cavern development and waste injection;
 - plans for cavern pressure tests and sonar surveys to establish cavern dimensions, volume, geometric shape and characterization of anomalies; and
 - management and/or disposal of all brines displaced from the cavern pursuant to applicable state and federal regulations.
 - The applicant's construction plan will need to include tests it will use to verify cavern dimensions including surveys, logs and tests to be run and analyzed and a method to test the integrity of the cavern.
 - Following major operations such as removal of the injection tubing, recompletions or unseating of the packer, well mechanical integrity must be demonstrated. If the integrity of the casing seat or cavern may be compromised, cavern integrity will have to be demonstrated.
 - Prior to beginning waste disposal and within 90 days after cavern construction is completed, the permittee must submit to the executive director a report sealed by a P.E. or P.G. as appropriate. The report must include the information listed in 30 TAC §331.45(3) and a certification that a notation on the deed to the facility property (or on another instrument normally examined during a title search) has been made. The notation will have to include:
 - the surveyed location of the cavern;
 - the well permit number;

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- the depth of the cavern floor and ceiling;
 - the diameter of the cavern
 - the dates the well and cavern were operated; and
 - the permitted waste streams.
- In connection with the report mentioned above, a P.E. or P.G., as appropriate, will have to certify that the cavern has been constructed according to the design and construction specifications in the application; that the actual confining zone and injection zone data obtained will not necessitate a change in the operating parameters specified in the permit; and that the bedded salt cavern injection zone is not in or above a formation which, within 1/4 mile, contains a USDW.
- Operating requirements.
 - Waste must be injected into the cavern through removable tubing(s) with a packer or fluid seal to seal the annulus between the outer tubing and long string casing.
 - The maximum injection pressure at the wellhead must not exceed 0.8 psi per foot measured at the higher elevation of either the long string casing seat or the highest interior elevation of the cavern roof.
 - A blanket material consisting of a nonhazardous substance such as crude oil, mineral oil, or other fluid possessing similar noncorrosive, nonsoluble, low-density properties must be placed into the salt cavern to prevent unwanted leaching of the cavern roof.
 - The blanket material must be sufficient to protect the integrity of cement and formation bond at the long string casing seat, and there must be a sufficient volume of blanket material to contact the entire cavern roof.
 - There must be no injection between the outermost casing protecting USDWs, and fresh or surface water and the wellbore.
 - For wells with a packer, the casing/tubing annulus pressure must be at least 100 psi greater than the injection tubing pressure.
 - The physical and chemical characteristics of injected materials must be compatible with and protective of the injection well, associated facilities and injection zone.
 - A density interface survey or alternate method must be used at least once every five years to monitor the cavern roof and level of the blanket material.
 - If the injection tubing is removed, the well is recompleted, or the packer is unseated, mechanical integrity of the well will have to be demonstrated following these activities.

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- Bedded salt cavern and well monitoring and testing requirements.
 - A waste analysis plan containing information as specified in 40 CFR §146.68(a) will be required for all material injected into or produced from the cavern.
 - Pressure gauges will be required on the tubing string(s) and on the annulus between the outer tubing and long string casing/liner.
 - Continuous recording devices will be required to record tubing string pressures; injection flow rate; injection fluid temperature, density and volume; volume and composition of displaced fluids and gases; and pressure and volume of any annular space extending to the wellhead. Semi-annual testing and calibration of all gauges and recording devices is required.
 - Automatic alarms must sound when pressures or flow rates exceed permitted values, and either an automatic shutoff system must be used or a trained operator must be on location and able to immediately respond to alarms at all times when the well is operating.
 - Mechanical integrity of the injection well and bedded salt cavern must be maintained when the well is in service. Mechanical integrity of the injection well and bedded salt cavern must be demonstrated before the cavern is initially placed in service (if cavern construction is not concurrent with waste disposal), routinely every 5 years, after workovers that involve removal of tubing, and before the well is plugged.
 - Mechanical integrity of the injection well will have to be tested using a nitrogen-brine interface method.
 - For the bedded salt cavern, integrity will have to be attested by using a hydrostatic brine test.
 - The maximum allowable operating pressure will have to be used in testing well and cavern integrity.
 - A temperature log or noise log will be required at least once every five years to test for fluid movement along the borehole.
 - An ambient monitoring program will have to be developed based on a site-specific assessment of the potential for waste and/or fluid movement from the well or injection zone and subsidence due to groundwater withdrawal or salt movement.
- Bedded salt cavern closure.
 - To close the cavern, the permittee will have to
 - remove the blanket pad;
 - fill the cavern with brine;

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- remove the tubing(s);
- conduct a gamma-density log to determine the cavern top, salt top and to check for fluid behind the casing;
- conduct a sonar caliper survey (if not performed within the past 5 years);
- set a gas tight mechanical bridge plug in the long string casing;
- conduct a pressure mechanical integrity test of the long string casing and plug;
- spot a 50-foot thick thixotropic cement plug on top of the mechanical bridge plug by pumping through tubing, and then test the plug;
- fill the casing with cement from the bridge plug to the surface by pumping cement through tubing and slowly withdrawing the tubing from the well;
- remove tubing from the well and fill the casing with cement to surface;
- pressure test the well to 300 psi;
- establish a monument for elevation survey purposes by leaving some casing above the ground surface; and
- flush or purge all brine and waste lines connected to the well.
- For post-closure care, the owner or operator will be required to:
 - continue and complete any required corrective action;
 - continue to conduct any required groundwater monitoring until pressure in the injection zone decays to the point that the well's cone of influence no longer intersects the base of the lowermost USDW or freshwater aquifer;
 - submit to the local zoning authority and to the TCEQ Underground Injection Control program a survey plat indicating the location of the well relative to permanently surveyed benchmarks;
 - provide appropriate notification and information to such state and local authorities as have cognizance over drilling activities to enable such state and local authorities to impose appropriate conditions on subsequent drilling activities that may penetrate the well's confining or injection zone; and
 - retain records reflecting the nature, composition, and volume of all injected fluids for 3 years.

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